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AN EXPERIMENT IN THE SUPERVISED STUDY OF MATHEMATICS

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The method of giving a double period, part to recitation and part to preparation of the lesson under the supervision of the instructor, has been used in comparatively few schools and in comparatively few subjects. In a few cases mathematics has been taught in this manner. This method gives an opportunity for taking care of the various abilities in the class and it is the opinion of most of those who have used the method that the results warrant its continuation. An objection on the part of school authorities arises from the supposed increased expense. In view of these facts it seemed useful to compare experimentally the efficiency of the supervised study of mathematics with that of the usual method and if possible to form some idea of their relative costs.

The experiment herein described was conducted with classes in beginning plane geometry. From a group of sixty students who were to begin this subject two classes were selected in the following manner. The names of the sixty students were written on cards which were then shuffled. From these cards thirty-six were drawn at random. These students had completed three semesters of algebra, and with the averages of their algebra grades as a basis the thirty-six students were divided into two groups of eighteen each and of abilities as nearly equal as possible.

The following table, in which *S* refers to the supervised class, *U* to the unsupervised class, gives a comparison of the algebra averages of the two classes:

AVERAGE OF		MEAN DEVIATION FROM OWN AVERAGE		AMOUNT OF VARIATION IN		NUMBER ABOVE TOTAL AVERAGE		NUMBER BELOW TOTAL AVERAGE	
S	U	S	U	S	U	S	U	S	U
86.68	87.2	4.61	5.35	28	21	9	10	9	8

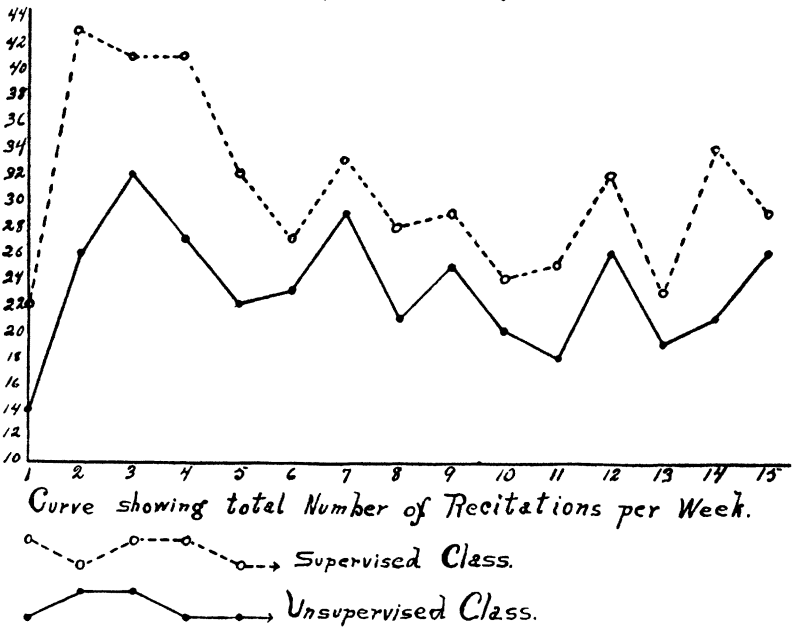
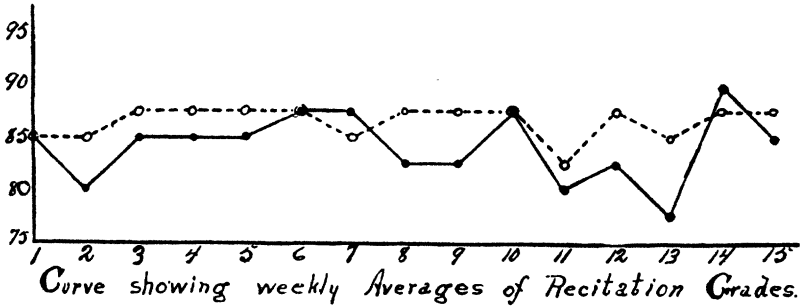
In four of the five points of comparison the unsupervised class has a slight advantage, while in the mean deviation the supervised class has the advantage. From this it would seem that the two classes were practically of the same ability, there being perhaps a slight advantage in favor of the unsupervised class.

The unsupervised class recited the first period in the day and then made their preparation in the study-room or at home. The supervised class recited the second period in the same manner as the other class did but remained the third period to make its preparation for the following day. During this period the students gave all of their time to the study of geometry with the understanding that they were not required to give any outside time to the subject. Each student of the supervised class kept a notebook at the instructor's desk. After the student had prepared his advanced lesson to his own satisfaction he was given additional work for his notebook, thus making it possible to keep every student busy during the entire hour. The students were free to call for help any time during the preparation period but all such help was given in the form of suggestions and questions. An effort was made to teach the child how to study geometry. Both classes were given the privilege of coming to the instructor for help during his consultation period, this help being given in the manner stated above.

A record of both the amount and the quality of the recitation work was kept. The amount of work was indicated by the number of times students made definite recitations, such as demonstrations and constructions. The quality of the work was indicated by a recitation grade given at the time the recitation was made. A comparison of these records for the two classes is shown in the graphs below. In each curve the horizontal units represent weeks. The vertical units of the first curve represent weekly averages, while those of the second curve represent the total number of recitations per week. The continuous curves represent the work of the unsupervised class and the dotted curves represent that of the supervised class. An examination of these curves shows that the supervised class had the higher average for ten of the fifteen weeks. The unsupervised class ranked higher for two weeks and the

averages were the same for the other three weeks. The second set of curves shows that the supervised class made the larger number of recitations every week throughout the semester.

In accordance with the school organization, at the close of the first and second six weeks examinations covering the work of those



periods were given. At the close of the semester a final examination covering the entire work of the semester was given. These examinations consisted of propositions and exercises previously discussed in class. At various times there were given tests consisting of exercises which had never been taken up in class. The

final examination covered a two-hour period; all the other tests covered forty-minute periods. The same questions were used for both classes in each test. In each examination more problems were given than any student could hope to solve and the students were told to answer as many as possible. With the exception of the final examination the papers were graded on a basis of the quality of work and the quantity of work did not enter into the grade. However, the number of problems solved was kept as a part of the student's record. In the case of the final examination the grade depended upon both the quality and the quantity of work. All papers were graded by the instructor but in such a manner that he did not know whose paper he was grading nor to which class it belonged until they were all graded.

The results of the examination are given in the following table:

KIND OF EXAMINATION	NO. OF EXAM.	AVERAGE OF CLASS		AVERAGE NUMBER SOLVED	
		Supervised	Unsupervised	Supervised	Unsupervised
Six-weeks Examinations.....	1	77.3	68.7	4.2	3.55
Final Examination.....	2	81.2	80.4	4.3	3.9
Tests consisting of New Materials.....	1	92.4	80.1	12.7	12.2
	1	82.4	73.9	4.8	4.4
	2	87.3	70.2	4.8	3.7
	3	77.6	56.2	2.1	2.1
	4	82.8	77.3	4.2	3.8

In each of the six-weeks examinations and the final examination the supervised class excelled in both the average grade and the average number of problems solved. As these examinations covered only the work discussed in recitation, the results indicate that this class had mastered the text better than the unsupervised class. In each of the remaining four tests the average grade of the supervised class was decidedly better than that of the unsupervised class and in only one case did the average number of problems solved by the unsupervised class equal that of the supervised class. As stated above, these tests consisted of problems which were new to both classes and the results therefore indicate that the supervised class was the more able to attack new problems, thus contradicting the arguments of those who believe that supervised study makes the student dependent upon the instructor.

As stated above, the members of the supervised class kept notebooks in which they wrote up exercises after they had completed their daily preparation. The weaker students did but little of this work but some of the stronger students had as many as fifty exercises in their notebooks. The average number for the class was eighteen. This not only resulted in an increase in the amount of work done by the class but afforded an excellent opportunity for adjusting the work to the various abilities of the class.

At the close of the semester all students of the supervised class had passing grades while two of the other class failed. This was true although one student¹ of the supervised class had been absent on account of sickness for three weeks, and the lowest algebra grade of this class was decidedly lower than the corresponding grade of the unsupervised class. The difference in these results is accounted for by the fact that the instructor had a better opportunity to give individual instruction to the weaker members of the supervised class.

At the beginning of the semester some of the students were opposed to supervised study and asked to be transferred to other classes. Soon this opposition died out and there came requests from members of other classes to be transferred into the supervised class. The final attitude of the members of both classes toward the work was indicated by their written answers to the following question which was asked at the close of the semester: "If a supervised class in second-semester plane geometry should be conducted next semester would you care to be in it?" Every student answered this question in the affirmative.

The students of each class were also asked to state approximately the amount of time outside of class spent in preparation. The average time thus spent by the supervised class was eight minutes, making a total of about forty-five minutes spent in their daily preparation, while the unsupervised class spent about forty-two minutes. The time spent by the two classes was practically the same but the supervised class had the advantage of continuous, intensive study in the presence of the instructor, who was ready to make suggestions whenever a student found himself in difficulty.

¹ This student missed the last three weeks of school, but returned for the final examination. He made a passing grade in the work he had studied but was conditioned to make up the three weeks' work during the summer.

The school officials object to the supervised study because of the additional expense. From the work of these two classes it is not possible to make an exact comparison of the costs of the two plans but some idea may be formed. During the semester the unsupervised class made 352 recitations, such as demonstrations of propositions, constructions, etc. The supervised class made 466 such recitations. This would enable the instructor to handle twenty-four students in the supervised class and keep as closely in touch with the individual as he does when he has eighteen in an unsupervised class. Most teachers with whom I have talked have expressed a willingness to handle four classes with supervised study rather than five with the other plan. This would allow the instructor to care for ninety-six students under the supervised plan against ninety under the ordinary method. It is argued that the difficulty in handling a class increases more rapidly than the number of students in the class. We admit the truth of this statement, but there are other factors in favor of supervised study which have not been considered in making this comparison. We have not taken into account the teacher's contact with the student during the study period which in itself is a strong factor in balancing the increased difficulty due to the larger number in the class. The decreased number of failures lessens the number of students repeating the subject and hence lessens the number of students to be handled as well as the deadening effect that such students have on the other members of the class. Consultation periods were kept by the instructor during which members of both classes were free to come for help. It naturally occurred that a large majority of these calls came from members of the unsupervised class. Such periods, so necessary under the ordinary method, would be needless if the supervised method were used.

The foregoing results seem to warrant the statement that supervised study of mathematics would not increase the expense of instruction as much as some have supposed and that the students under such instruction not only master the text more thoroughly but are more able to take the initiative in new work than are the students under the unsupervised plan.